Space Weather Technical Forecast

Issued on Thursday, 18 January 2024 at 00:24 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of isolated M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with only minor C-class flares. There are now twelve sunspot regions on the visible disc, with AR3540 and AR3541 both in the process of rotating off the west limb and no longer properly visible. AR3558 is also close to the west limb and is therefore difficult to assess, but has only emerged recently. The new region on the northeast limb is now showing a trailer spot. The reverse polarity spot north of the leader in AR3553 has now mostly faded, but the trailer spot may have developed a weak delta region. Nearby AR3554 has also developed a weak reverse polarity spot to the southwest of the main spot.
No Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: Solar winds, as observed at L1 by ACE and DSCOVR, were at background to slightly elevated levels, although DSCOVR is likely over-estimating the wind speeds. Wind speeds appeared to ease from around 430 km/s to near 300 km/s. Density has been below average, perhaps increasing somewhat in recent hours, although again DSCOVR's values may be a little suspect. The interplanetary magnetic field (IMF) has been weak throughout, below 6nT. The north-south component was weak but mainly negative (southward directed). Phi angle was variable. Geomagnetic activity was Quiet (Kp 0-1).

Energetic Particles / Solar Radiation: GOES18 high energy (greater than 10MeV) proton flux was at background levels. GOES16 high energy (greater than 2MeV) electron flux was at background levels. The associated 24-hour fluence was well below Active (1e8 integrated pfu) on a steady trend. The 18/0000 UTC 24-hour integrated fluence observation was 1.37e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low activity is expected, but with a chance of rising to Moderate due to isolated M-class flares.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs currently expected. The current slow wind conditions may transition to a weak fast wind from CH92/+ during Day 1 (18 Jan). Slightly elevated speeds of 400-450km/s are possible briefly, likely easing through Day 2 (19 Jan). Then a further fast wind enhancement, and return of slightly elevated speeds, is possible from CH93/+ on Day 3 (20 Jan).
Geomagnetic activity is expected to be largely Quiet, however any fast winds will likely bring a spell of Unsettled intervals with a chance of Active, mainly on Day 1 and again on Days 3-4.

Energetic Particles / Solar Radiation: High energy proton flux is forecast to remain at background levels, with a very slight chance of radiation storms occurring. The high energy electron flux is likely to be at background to moderate levels, perhaps rising later in the period. The associated fluence is expected to remain below the Active threshold.

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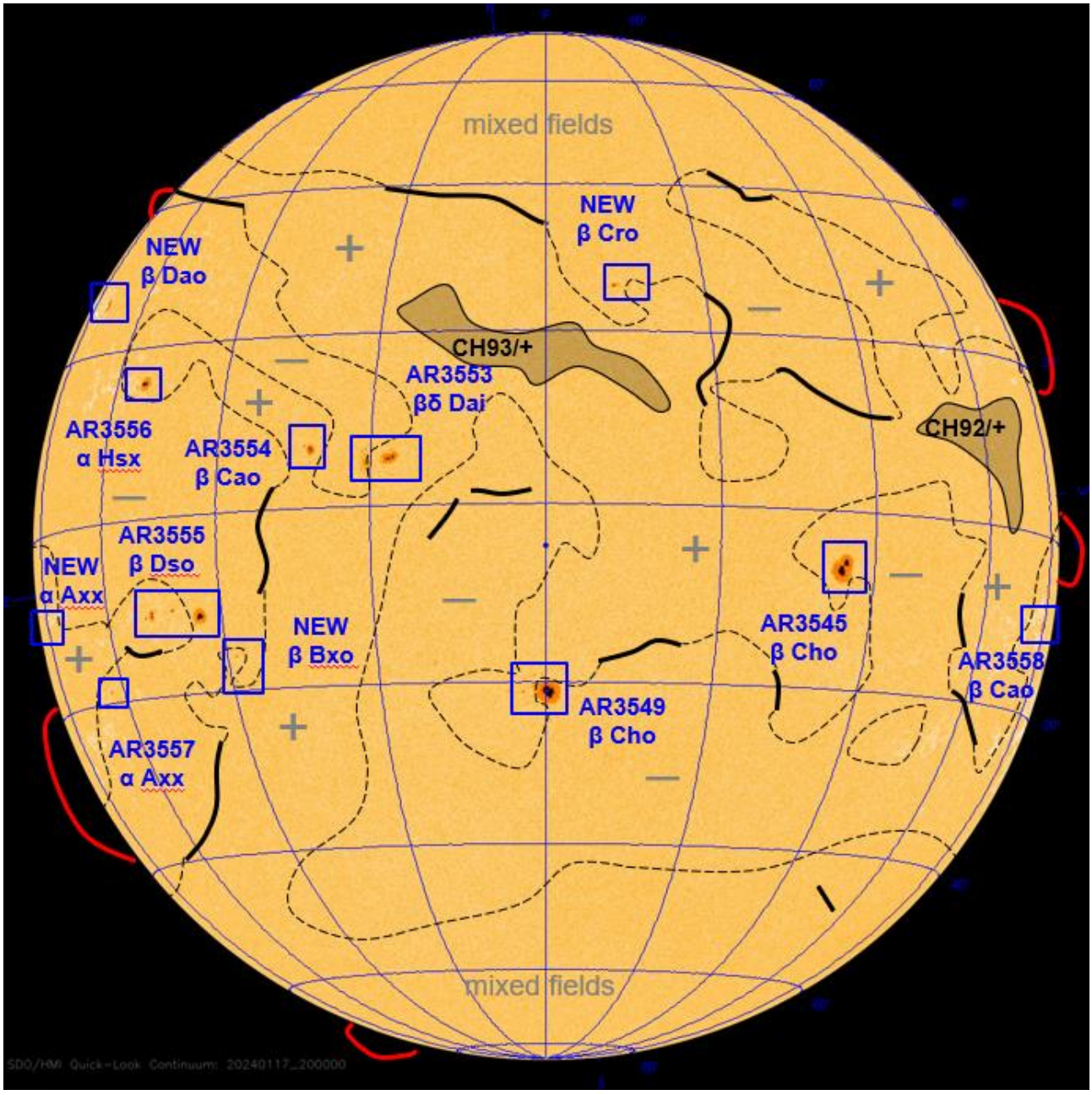
Figure 1. Solar Analysis Valid 17/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no Earth-directed CMEs currently expected.

The current slow wind conditions may transition to a weak fast wind from CH92/+ during Day 1 (18 Jan). There is some uncertainty, however, in whether we see much from this feature with it being located in the solar northern hemisphere, and Earth well to the south of the solar equator. Slightly elevated speeds of 400-450km/s are possible briefly, likely easing through Day 2 (19 Jan). Then a further fast wind enhancement, and return of slightly elevated speeds, is possible from CH93/+ on Day 3 (20 Jan). This is also a northern hemisphere feature so again any fast wind may pass largely above Earth. MOSWOC Enlil is suggesting a general increase in wind speeds through this period up to 500-550 km/s, which is considered likely to be overdone at this time. Both coronal holes are positive polarity, which is becoming less favoured for geomagnetic response at this time of year.

Geomagnetic activity is expected to be largely Quiet, however any fast winds will likely bring a spell of Unsettled intervals with a chance of Active, mainly on Day 1 and again on Day 3.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

No Earth directed CMEs are currently expected.

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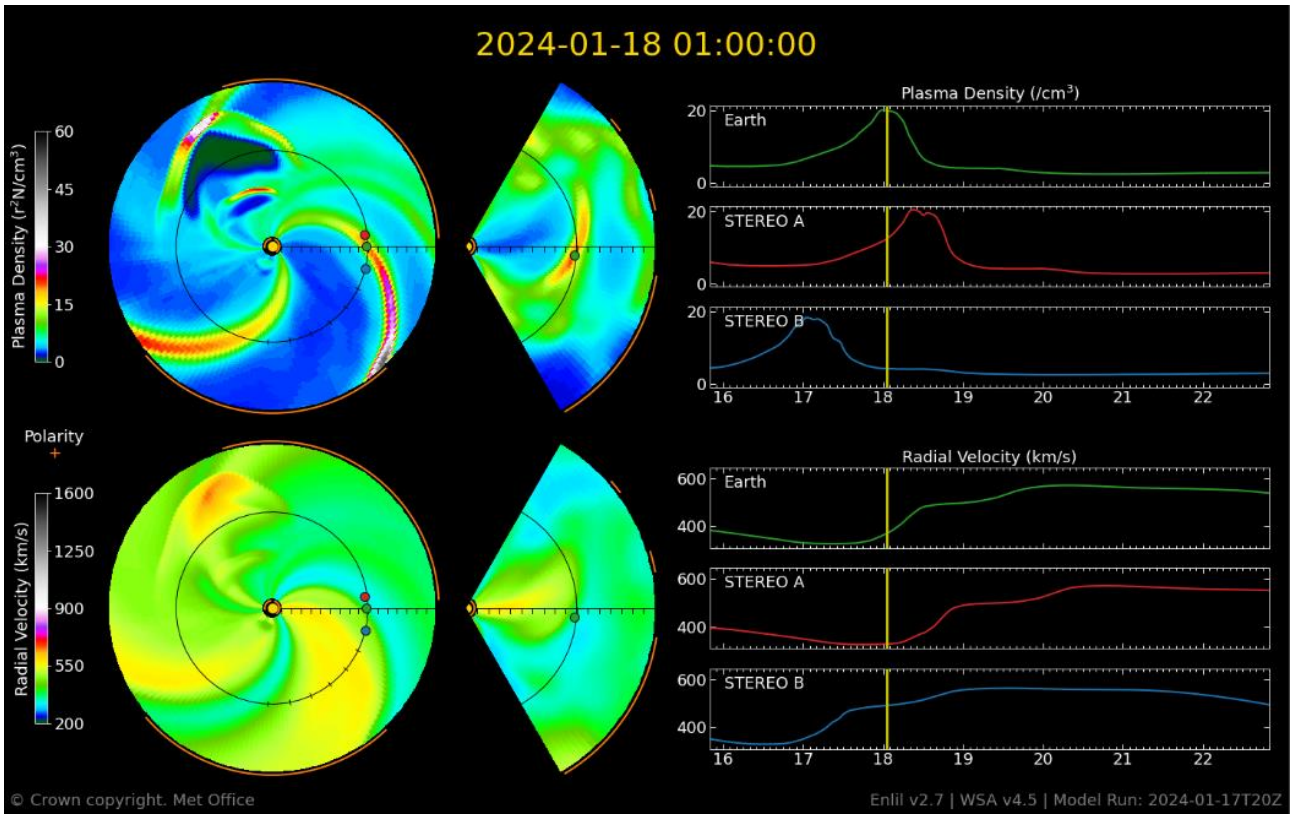
Figure 2: MOSWOC Enlil showing an increase in wind speed over the next couple of days to around 550 km/s. This is considered overdone, with a much more modest increase possible on 18 Jan, and again a modest increase on 20 Jan.



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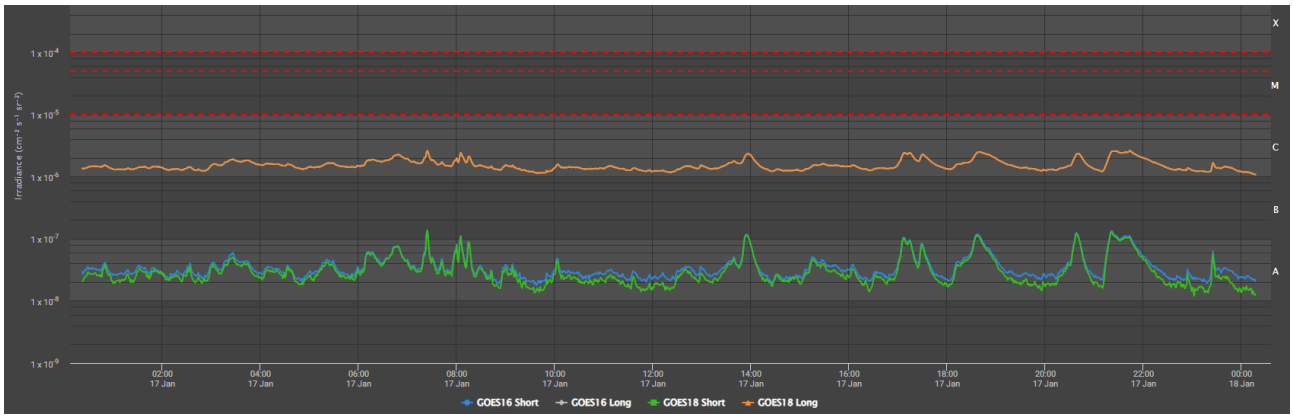
Radio Blackouts - X-Ray Flares:
There are now twelve sunspot regions on the visible disc, with AR3540 and AR3541 both in the process of rotating off the west limb and no longer properly visible. AR3558 is also close to the west limb and is therefore difficult to assess, but has only emerged recently. The new region on the northeast limb has now shown a trailer spot, leading to an increase in classification. The reverse polarity spot north of the leader in AR3553 has now mostly faded, but the trailer spot may have developed a weak delta region. Nearby AR3554 has also developed a weak reverse polarity spot to the southwest of the main spot. Overall, despite the large number of regions, most of them are relatively simple at this time keeping the flare risk relatively low.

Low activity is likely to continue, with a chance of isolated M-class flares. A slight uptick in probability of flaring is indicated through the coming days, closer to the climatological risk for this point in the solar cycle.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	35	35	40
Very Active	R3 to R5 X Class	No	2	2	5	5

Figure 3: X-ray flare trace at GOES16 and 18 showing only low level C-class flares.



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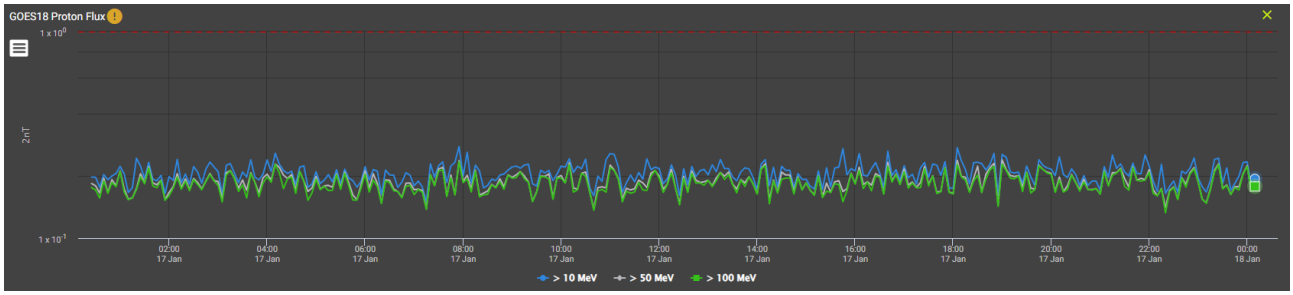
Solar Radiation Storms - (High Energy Protons):
GOES18 high energy (greater than 10MeV) proton flux is currently at background levels and expected to remain so through the period. Given the number of sunspots, including those soon to rotate off the southwest limb, there remains a slight chance of proton flux increasing should there be any notable flares. This brings a very slight chance of exceeding the S1 Minor Radiation Storm thresholds.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

Figure 4: Background proton flux at GOES18.



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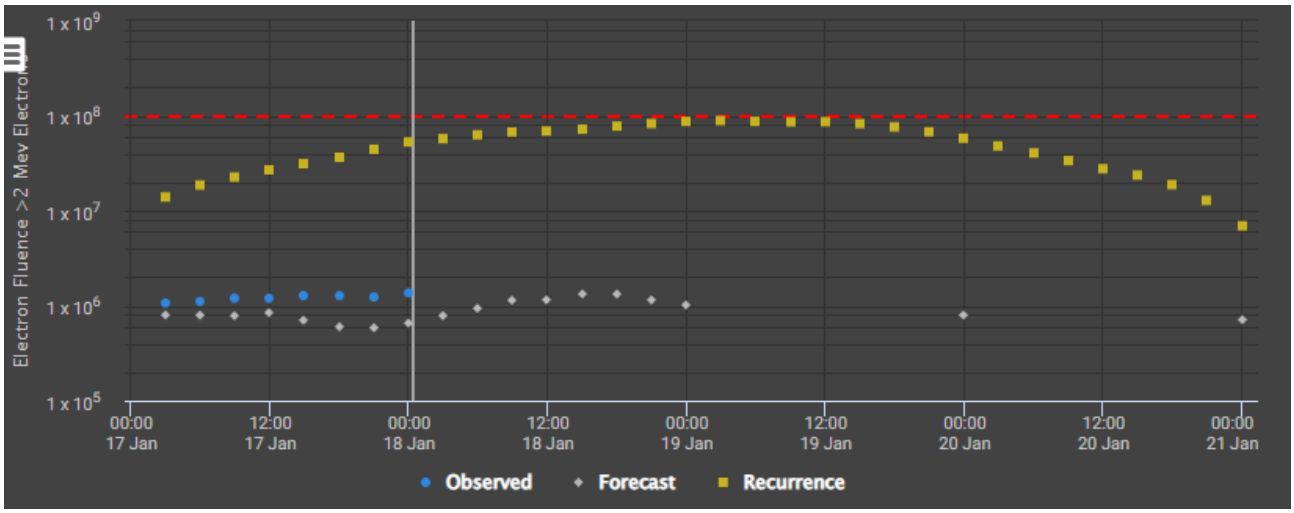
High Energy Electrons Event (≥ 2MeV):
High energy electron flux (greater than 2MeV) as measured by GOES16 at GEO is currently at background levels. Any fast wind onset from CH92/+ on Day 1 (18 Jan) is expected to be weak, and as such any electron flux enhancement is likely to be very limited. In addition, the onset of the fast winds of CH93/+ on Day 3 (20 Jan) will suppress any increase in flux which may have occurred. An increase is possible on Day 4 if the fast winds from CH93 have started to ease, but it is more likely that any response will be after the end of this period.

The associated 24 hour fluence is expected to remain below the Active level, perhaps with a rising trend later Day 4. REFM is providing good guidance for the short term, until any fast wind starts to appear.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}\,sr^{-1}\,day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: MOSWOC REFM forecast showing a below Active trend, which seems reasonable.



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